What is claimed is:

1. An infrared radiation photodetector comprising:

a plurality of first elongate semiconductor elements for absorbing infrared radiation thereby creating electrical carriers, the plurality of first elongate elements being arranged to form a first one-dimensional diffraction grating for infrared radiation;

a plurality of second elongate semiconductor elements for absorbing infrared radiation thereby creating electrical carriers, the plurality of second elongate elements being arranged to form a second one-dimensional diffraction grating for infrared radiation, the plurality of second elongate elements being substantially perpendicular to and intersecting the plurality of first elongate elements so as to form a two-dimensional diffraction grating having a first common major surface and a second common major surface, the second common major surface being opposite the first common major surface;

at least a portion of at least one of the first and second elongate elements being enlarged so as to form a collector element, each collector element forming a portion of the first common major surface and a portion of the second common major surface;

at least one semiconductor carrier collector for collecting electrical carriers thus created by the first and second elongate elements, each respective carrier collector being formed in a portion of a respective collector element so as to form a portion of one of the first common major surface and the second common major surface;

a first electrical contact which is electrically connected to the at least one carrier collector;

a second electrical contact which is electrically connected to at least one of the plurality of first elongate elements and the plurality of second elongate elements, the first contact and the second contact being disposed so as to provide for electrical carrier flow through the first and second elongate elements; and

a reflector for infrared radiation, the reflector being closer to the second common major surface of the two-dimensional diffraction grating than to the first common major surface of the two-dimensional diffraction grating.

2. An infrared radiation photodetector in accordance with claim 1, wherein each respective one of the at least one collector element is formed at a respective intersection of a first elongate element and a second elongate element.

3. An infrared radiation photodetector in accordance with claim 1, wherein each intersection of a first elongate element and a second elongate element includes a respective collector element.

4. An infrared radiation photodetector in accordance with claim 1, wherein each respective one of the at least one collector element is formed in a first elongate element substantially midway between a first intersection of that first elongate element and one second elongate element and a second intersection of that first elongate element and a different second elongate element, the one second elongate element being adjacent to the different second elongate element.

5. An infrared radiation photodetector in accordance with claim 1, wherein a respective one of the at least one collector element is formed in each respective first elongate element substantially midway between a respective first intersection of that respective first elongate element and a respective one second elongate element and a respective second intersection of that respective first elongate element and a respective different second elongate element, the respective one second elongate element being adjacent to the respective different second elongate element.

6. An infrared radiation photodetector in accordance with claim 1,

wherein a first one of the at least one collector element is formed at a respective intersection of a first elongate element and a second elongate element, and

wherein at least a second one of the at least one collector element is formed in a second first elongate element substantially midway between a first intersection of that second first elongate element and one second elongate element and a second intersection of that second first elongate element and a different second elongate element, the one second elongate element being adjacent to the different second elongate element.

7. An infrared radiation photodetector in accordance with claim 1, wherein the plurality of first elongate elements, the plurality of second elongate elements, and the at least one collector element comprise n-type semiconductor material and the at least one carrier collector comprises p-type semiconductor material.

8. An infrared radiation photodetector in accordance with claim 1, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise II-VI semiconductor material.

9. An infrared radiation photodetector in accordance with claim 8, wherein the semiconductor material comprises HgCdTe semiconductor material.

10. An infrared radiation photodetector in accordance with claim 1, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise III-V semiconductor material.

11. An infrared radiation photodetector in accordance with claim 10, wherein the semiconductor material comprises InSb semiconductor material.

12. An infrared radiation photodetector in accordance with claim 10, wherein the semiconductor material comprises InGaAs semiconductor material.

13. An infrared radiation photodetector in accordance with claim 1, wherein the first contact and the at least one carrier collector are adjacent to the first common major surface of the two-dimensional diffraction grating and the second contact is adjacent to the second common major surface of the two-dimensional diffraction grating.

14. An infrared radiation photodetector in accordance with claim 1, wherein the first contact, the at least one carrier collector, and the second contact are adjacent the second common major surface of the two-dimensional diffraction grating.

15. An infrared radiation photodetector in accordance with claim 1, wherein each of the at least one collector element is a circular disk.

16. An infrared radiation photodetector in accordance with claim 1, wherein a period of the first one-dimensional diffraction grating and a period of the second one-dimensional diffraction grating are equal to each other.

17. An infrared radiation photodetector in accordance with claim 1,

wherein the first diffraction grating resonates at a first infrared radiation wavelength;

wherein the second diffraction grating resonates at a second infrared radiation wavelength; and

wherein the first infrared radiation wavelength is within ten percent of the second infrared radiation wavelength.

18. An infrared radiation photodetector in accordance with claim 1, wherein the reflector comprises a metal or a metal alloy.

19. An infrared radiation photodetector in accordance with claim 1, wherein the reflector comprises a Bragg reflector.

20. An infrared radiation photodetector in accordance with claim 1, further comprising a first passivation layer disposed on the two-dimensional diffraction grating.

21. An infrared radiation photodetector in accordance with claim 1, further comprising a second passivation layer disposed between the second common major surface of the two-dimensional diffraction grating and the reflector.

22. An infrared radiation photodetector in accordance with claim 1:

wherein the plurality of first elongate elements, the plurality of second elongate elements, and the at least one collector element comprise n-type semiconductor material and the at least one carrier collector comprises p-type semiconductor material, and

wherein the reflector comprises a metal or a metal alloy.

23. An infrared radiation photodetector in accordance with claim 22, wherein each intersection of a first elongate element and a second elongate element includes a respective collector element.

24. An infrared radiation photodetector in accordance with claim 22, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise II-VI semiconductor material.

25. An infrared radiation photodetector in accordance with claim 22, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise III-V semiconductor material.

26. An infrared radiation photodetector in accordance with claim 22, wherein the first contact, the at least one carrier collector, and the second contact are adjacent the second common major surface of the two-dimensional diffraction grating.

27. An infrared radiation photodetector in accordance with claim 22, further comprising a first passivation layer disposed on the two-dimensional diffraction grating.

28. An infrared radiation photodetector in accordance with claim 22, further comprising a second passivation layer disposed between the second common major surface of the two-dimensional diffraction grating and the metallic reflector.

29. An infrared radiation photodetector in accordance with claim 1:

wherein the plurality of first elongate elements, the plurality of second elongate elements, and the at least one collector element comprise n-type HgCdTe semiconductor material and the at least one carrier collector comprises p-type HgCdTe semiconductor material,

wherein a period of the first one-dimensional diffraction grating and a period of the second one-dimensional diffraction grating are equal to each other,

wherein each intersection of a first elongate element and a second elongate element includes a respective collector element,

wherein the first contact, the at least one carrier collector, and the second contact are adjacent the second common major surface of the two-dimensional diffraction grating, and

wherein the reflector comprises a metal or a metal alloy.

30. An infrared radiation photodetector focal plane array including a plurality of photodetector pixel structures, each of the pixel structures comprising:

a plurality of first elongate semiconductor elements for absorbing infrared radiation thereby creating electrical carriers, the plurality of first elongate elements being arranged to form a first one-dimensional diffraction grating for infrared radiation;

a plurality of second elongate semiconductor elements for absorbing infrared radiation thereby creating electrical carriers, the plurality of second elongate elements being arranged to form a second one-dimensional diffraction grating for infrared radiation, the plurality of second elongate elements being substantially perpendicular to and intersecting the plurality of first elongate elements so as to form a two-dimensional diffraction grating having a first common major surface and a second common major surface, the second common major surface being opposite the first common major surface;

at least a portion of at least one of the first and second elongate elements being enlarged so as to form a collector element, each collector element forming a portion of the first common major surface and a portion of the second common major surface;

at least one semiconductor carrier collector for collecting electrical carriers thus created by the first and second elongate elements, each respective carrier collector being formed in a portion of a respective collector element so as to form a portion of one of the first common major surface and the second common major surface;

a first electrical contact which is electrically connected to the at least one carrier collector;

a second electrical contact which is electrically connected to at least one of the plurality of first elongate elements and the plurality of second elongate elements, the first contact and the second contact being disposed so as to provide for electrical carrier flow through the first and second elongate elements; and

a reflector for infrared radiation, the reflector being closer to the second common major surface of the two-dimensional diffraction grating than to the first common major surface of the two-dimensional diffraction grating.

31. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein each respective one of the at least one collector element is formed at a respective intersection of a first elongate element and a second elongate element in each one of the pixel structures.

32. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein each intersection of a first elongate element and a second elongate element in each one of the pixel structures includes a respective collector element.

33. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein each respective one of the at least one collector element in each one of the pixel structures is formed in a first elongate element substantially midway between a first intersection of that first elongate element and one second elongate element and a second intersection of that first elongate element and a different second elongate element, the one second elongate element being adjacent to the different second elongate element.

34. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein a respective one of the at least one collector element in each one of the pixel structures is formed in each respective first elongate element substantially midway between a respective first intersection of that respective first elongate element and a respective one second elongate element and a respective second intersection of that respective first elongate element and a respective different second elongate element, the respective one second elongate element being adjacent to the respective different second elongate element.

35. An infrared radiation photodetector focal plane array in accordance with claim 30,

wherein a first one of the at least one collector element in each one of the pixel

structures is formed at a respective intersection of a first elongate element and a second elongate element, and

wherein at least a second one of the at least one collector element in each one of the pixel structures is formed in a second first elongate element substantially midway between a first intersection of that second first elongate element and one second elongate element and a second intersection of that second first elongate element and a different second elongate element, the one second elongate element being adjacent to the different second elongate element.

36. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the plurality of first elongate elements, the plurality of second elongate elements, and the at least one collector element comprise n-type semiconductor material and the at least one carrier collector comprises p-type semiconductor material in each one of the pixel structures.

37. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise II-VI semiconductor material in each one of the pixel structures.

38. An infrared radiation photodetector focal plane array in accordance with claim 37, wherein the semiconductor material comprises HgCdTe semiconductor material in each one of the pixel structures.

39. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise III-V semiconductor material in each one of the pixel structures.

40. An infrared radiation photodetector focal plane array in accordance with claim 39, wherein the semiconductor material comprises InSb semiconductor material in each one of the pixel structures.

41. An infrared radiation photodetector focal plane array in accordance with claim 39, wherein the semiconductor material comprises InGaAs semiconductor material in each one of the pixel structures.

42. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the first contact and the at least one carrier collector are adjacent to the first common major surface of the two-dimensional diffraction grating and the second contact is adjacent to the second common major surface of the two-dimensional diffraction grating in each one of the pixel structures.

43. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the first contact, the at least one carrier collector, and the second contact are adjacent the second common major surface of the two-dimensional diffraction grating in each one of the pixel structures.

44. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein each of the at least one collector element in each one of the pixel structures is a circular disk.

45. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein a period of the first one-dimensional diffraction grating and a period of the second one-dimensional diffraction grating are equal to each other in each one of the pixel structures.

46. An infrared radiation photodetector focal plane array in accordance with claim 30,

wherein the first diffraction grating in each one of the pixel structures resonates at a first infrared radiation wavelength;

wherein the second diffraction grating in each one of the pixel structures resonates at a second infrared radiation wavelength; and

wherein the first infrared radiation wavelength is within ten percent of the second infrared radiation wavelength in each one of the pixel structures.

47. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the reflector in each one of the pixel structures comprises a metal or a metal alloy.

48. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the reflector in each one of the pixel structures comprises a Bragg reflector.

49. An infrared radiation photodetector focal plane array in accordance with claim 30, further comprising a first passivation layer disposed on the two-dimensional diffraction grating in each one of the pixel structures.

50. An infrared radiation photodetector focal plane array in accordance with claim 30, further comprising a second passivation layer disposed between the second common major surface of the two-dimensional diffraction grating and the reflector in each one of the pixel structures.

51. An infrared radiation photodetector focal plane array in accordance with claim 30:

wherein the plurality of first elongate elements, the plurality of second elongate elements, and the at least one collector element comprise n-type semiconductor material and the at least one carrier collector comprises p-type semiconductor material in each one of the pixel structures, and

wherein the reflector in each one of the pixel structures comprises a metal or a metal alloy.

52. An infrared radiation photodetector focal plane array in accordance with claim 51, wherein each intersection of a first elongate element and a second elongate element includes a respective collector element in each one of the pixel structures.

53. An infrared radiation photodetector focal plane array in accordance with claim 51, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise II-VI semiconductor material in each one of the pixel structures.

54. An infrared radiation photodetector focal plane array in accordance with claim 51, wherein the plurality of first elongate elements, the plurality of second elongate elements, the at least one collector element, and the at least one carrier collector comprise III-V semiconductor material in each one of the pixel structures.

55. An infrared radiation photodetector focal plane array in accordance with claim 51, wherein the first contact, the at least one carrier collector, and the second contact are adjacent the second common major surface of the two-dimensional diffraction grating in each one of the pixel structures.

56. An infrared radiation photodetector focal plane array in accordance with claim 51, further comprising a first passivation layer disposed on the two-dimensional diffraction grating in each one of the pixel structures.

57. An infrared radiation photodetector focal plane array in accordance with claim 51, further comprising a second passivation layer disposed between the second common major surface of the two-dimensional diffraction grating and the metallic reflector in each one of the pixel structures.

58. An infrared radiation photodetector focal plane array in accordance with claim 30:

wherein the plurality of first elongate elements, the plurality of second elongate elements, and the at least one collector element comprise n-type HgCdTe semiconductor

material and the at least one carrier collector comprises p-type HgCdTe semiconductor material in each one of the pixel structures,

wherein a period of the first one-dimensional diffraction grating and a period of the second one-dimensional diffraction grating are equal to each other in each one of the pixel structures,

wherein each intersection of a first elongate element and a second elongate element includes a respective collector element in each one of the pixel structures,

wherein the first contact, the at least one carrier collector, and the second contact are adjacent the second common major surface of the two-dimensional diffraction grating in each one of the pixel structures, and

wherein the reflector in each one of the pixel structures comprises a metal or a metal alloy.

59. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the focal plane array is a one-dimensional focal plane array.

60. An infrared radiation photodetector focal plane array in accordance with claim 30, wherein the focal plane array is a two-dimensional focal plane array.